FB SERIES
STANDARD STAGES
FB Series

Precision Motorized Alignment Stages

Product Features

- Linear stages for 20mm to 200mm travel.
- Rotary Stage for continues motion
- Z-Wedge stage for 10mm travel
- Nanomotion’s direct drive piezo motor with zero backlash and no hysteresis.
- Integrated 100nm (0.1µm) optical encoder.

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
Table of Contents

- FBS050020-10004 Linear Piezo Stage ................................................. 1
- FBV050020-10004 Linear Piezo Vacuum Stage ................................. 3
- FBS050050-10004 Linear Piezo Stage ................................................. 5
- FBV050050-10004 Linear Piezo Vacuum Stage ................................. 7
- FBS075040-10008 Linear Piezo Stage .................................................. 9
- FBV075040-10008 Linear Piezo Vacuum Stage ................................. 11
- FBS075060-10008 Linear Piezo Stage ............................................... 13
- FBV075060-10008 Linear Piezo Vacuum Stage ................................. 15
- FBS075100-10008 Linear Piezo Stage ............................................... 17
- FBV075100-10008 Linear Piezo Vacuum Stage ................................. 19
- FBS100100-10008 Linear Piezo Stage ............................................... 21
- FBV100100-10008 Linear Piezo Vacuum Stage ................................. 23
- FBS150150-10008 Linear Piezo Stage ............................................... 25
# Stages

## Table of Contents

- FBV150150-10008 Linear Piezo Vacuum Stage ................................ 27
- FBS150200-10008 Linear Piezo Stage ........................................ 29
- FBV150200-10008 Linear Piezo Vacuum Stage ................................. 31
- FBZ075010-10004 Vertical Piezo Stage ........................................... 33
- FZV075010-10004 Vertical Piezo Vacuum Stage .............................. 35
- FGS100120-10004 Vertical Piezo Stage ........................................... 37
- FGV100120-10008 Vertical Piezo Vacuum Stage ............................. 39
- FGS100160-10004 Tilt Stage .............................................................. 41
- FGV100160-10004 Tilt Vacuum Stage ............................................... 43
- FRS060360-00504 Rotary Piezo Stage .............................................. 45
- FRV060360-00504 Rotary Piezo Vacuum Stage ............................... 47
- FB Standard Series Stages —Technical Information .........................49
- FB Standard Series Stages —Application Work Sheet .......................55

NOTE: Specifications subject to change without notice.
Linear Piezo Stage

Product Features

- Travel Range up to 20mm
- Motor: HR4
- Velocity up to 200mm/sec
- Load capacity up to 1kg
- Encoder resolution 0.1µm (optional to 10nm)

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision crossed roller with anti-migration device
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
- **Cable Lengths:** 3m
- **MTBF:** 30,000 hours
- **Stage Mass (g):** 400
- **Moving Mass (g):** 150

Performance Specifications

- **Travel Range (mm):** 20
- **Encoder Resolution (µm):** 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec):** 200
- **Straightness & Flatness (µm):** +/- 2
- **Pitch & Yaw (µrad):** +/- 25
- **Load Capacity (horizontal) (kg):** 1
- **Load Capacity (vertical lift) (kg):** 0.65
- **Dynamic Stall Force (N):** 16
- **Motor Stiffness (N/µ):** 2.8

MECHANICAL DRAWINGS

[All drawings are shown in European view]
**Ordering Information**

Part Number: FBV050020-10004
Vacuum Stage up to 10^-7 Torr

Part Number: FBU050020-10004
UHV Stage up to 10^-10 Torr

---

**Product Features**

- Travel Range up to 20mm
- Motor: HR4
- Velocity up to 100mm/sec
- Load capacity up to 2kg
- Encoder resolution 0.1µm (optional to 10nm)

**Product Description**

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
FBV050020-10004

Linear Piezo Vacuum Stage

TECHNICAL SPECIFICATIONS

- **Stage Plate Structure**: Aluminum
- **Motor**: Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings**: Precision stainless steel crossed roller with anti-migration device
- **Encoder**: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
- **Cable Lengths**: 3m
- **MTBF**: 30,000 hours
- **Stage Mass** (g): 400
- **Moving Mass** (g): 150

Performance Specifications

- **Travel Range (mm)**: 20
- **Encoder Resolution (µm)**: 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm)**: 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec)**: 200
- **Straightness & Flatness (µm)**: +/- 2
- **Pitch & Yaw (µrad)**: +/- 25
- **Load Capacity (horizontal) (kg)**: 1
- **Load Capacity (vertical lift) (kg)**: 0.65
- **Dynamic Stall Force (N)**: 16
- **Motor Stiffness (N/µ)**: 2.8
- **Outgassing data**: <1% TML; <0.1% CVCM

MECHANICAL DRAWINGS

[All drawings are shown in European view]
Product Features

- Travel Range up to 50mm
- Motor: HR4
- Velocity up to 200mm/sec
- Load capacity up to 2kg
- Encoder resolution 0.1µm (optional to 10nm)

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

Stage plate structure: Aluminum
Motor: Piezo Electric, Ultrasonic Standing Wave
Linear Bearings: Precision crossed roller with anti-migration device
Encoder: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
Cable Lengths: 3m
MTBF: 30,000 hours
Stage Mass (g): 610
Moving Mass (g): 226

Performance Specifications

Travel Range (mm): 50
Encoder Resolution (μm): 0.1 standard; (10nm optional)
Bi-directional Repeatability (μm): 1.0 standard; (0.1μm optional)
Maximum Velocity (mm/sec): 200
Straightness & Flatness (μm): +/- 2
Pitch & Yaw (μrad): +/- 25
Load Capacity (horizontal) (kg): 2
Load Capacity (vertical lift) (kg): 0.65
Dynamic Stall Force (N): 16
Motor Stiffness (N/μ): 2.8

MECHANICAL DRAWINGS

[All drawings are shown in European view]
Product Features

- Travel Range up to 50mm
- Motor: HR4
- Velocity up to 100mm/sec
- Load capacity up to 2kg
- Encoder resolution 0.1µm (optional to 10nm)

Product Description

The FB Series of alignment stages are driven by Nanomotion's ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**Linear Piezo Vacuum Stage**

### TECHNICAL SPECIFICATIONS

**Mechanical Design Characteristics**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage Plate Structure</strong></td>
<td>Aluminum</td>
</tr>
<tr>
<td><strong>Motor</strong></td>
<td>Piezo Electric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td><strong>Linear Bearings</strong></td>
<td>Precision stainless steel crossed roller with anti-migration device</td>
</tr>
<tr>
<td><strong>Encoder</strong></td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
<tr>
<td><strong>Cable Lengths</strong></td>
<td>3m</td>
</tr>
<tr>
<td><strong>MTBF</strong></td>
<td>30,000 hours</td>
</tr>
<tr>
<td><strong>Stage Mass (g)</strong></td>
<td>610</td>
</tr>
<tr>
<td><strong>Moving Mass (g)</strong></td>
<td>226</td>
</tr>
</tbody>
</table>

**Performance Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel Range (mm)</strong></td>
<td>50</td>
</tr>
<tr>
<td><strong>Encoder Resolution (µm)</strong></td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td><strong>Bi-directional Repeatability (µm)</strong></td>
<td>1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td><strong>Maximum Velocity (mm/sec)</strong></td>
<td>200</td>
</tr>
<tr>
<td><strong>Straightness &amp; Flatness (µm)</strong></td>
<td>+/- 2</td>
</tr>
<tr>
<td><strong>Pitch &amp; Yaw (µrad)</strong></td>
<td>+/- 25</td>
</tr>
<tr>
<td><strong>Load Capacity (horizontal) (kg)</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Load Capacity (vertical lift) (kg)</strong></td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Dynamic Stall Force (N)</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Motor Stiffness (N/µ)</strong></td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Outgassing data</strong></td>
<td>&lt;1% TML; &lt;0.1% CVCM</td>
</tr>
</tbody>
</table>

### MECHANICAL DRAWINGS

[All drawings are shown in European view]

![Diagram of Linear Piezo Vacuum Stage](image.png)

---

**Nanomotion Ltd.**
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel

- Tel: +972 73 2498000
- Fax: +972 73 2498099
- Email: nano@nanomotion.com

**Nanomotion Inc.**
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779

- Tel: (800) 821-6266
- Fax: (831) 585-3000
- Email: nanoUS@nanomotion.com
Product Features

- Travel Range up to 40mm
- Motor: HR8
- Velocity up to 200mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1μm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion's ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
Linear Piezo Stage

TECHNICAL SPECIFICATIONS

- **Mechanical Design Characteristics**
  - Stage Plate Structure: Aluminum
  - Motor: Piezo Electric, Ultrasonic Standing Wave
  - Linear Bearings: Precision crossed roller with anti-migration device
  - Encoder: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

- **Performance Specifications**
  - Travel Range (mm): 40
  - Encoder Resolution (µm): 0.1 standard; (10nm optional)
  - Bi-directional Repeatability (µm): 1.0 standard; (0.1µm optional)
  - Maximum Velocity (mm/sec): 200
  - Straightness & Flatness (µm): +/- 4
  - Pitch & Yaw (µrad): +/- 40
  - Load Capacity (horizontal) (kg): 3
  - Load Capacity (vertical lift) (kg): 1.0
  - Dynamic Stall Force (N): 32
  - Motor Stiffness (N/µ): 3.0

MECHANICAL DRAWINGS

[All drawings are shown in European view]
FBV075040-10008

Linear Piezo Vacuum Stage

ORDERING INFORMATION
Part Number: FBV075040-10008
Vacuum Stage up to 10^-7 Torr

Part Number: FBU075040-10008
UHV Stage up to 10^-10 Torr

Product Features

- Travel Range up to 40mm
- Motor: HR8
- Velocity up to 200mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

**Mechanical Design Characteristics**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Motor</td>
<td>Piezo Electric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td>Linear Bearings</td>
<td>Precision stainless steel crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder</td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
<tr>
<td>Cable Lengths</td>
<td>3m</td>
</tr>
<tr>
<td>MTBF</td>
<td>30,000 hours</td>
</tr>
<tr>
<td>Stage Mass (g)</td>
<td>755</td>
</tr>
<tr>
<td>Moving Mass (g)</td>
<td>302</td>
</tr>
</tbody>
</table>

**Performance Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Range (mm)</td>
<td>40</td>
</tr>
<tr>
<td>Encoder Resolution (µm)</td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td>Bi-directional Repeatability (µm)</td>
<td>1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td>Maximum Velocity (mm/sec)</td>
<td>200</td>
</tr>
<tr>
<td>Straightness &amp; Flatness (µm)</td>
<td>+/- 4</td>
</tr>
<tr>
<td>Pitch &amp; Yaw (µrad)</td>
<td>+/- 40</td>
</tr>
<tr>
<td>Load Capacity (horizontal) (kg)</td>
<td>3</td>
</tr>
<tr>
<td>Load Capacity (vertical lift) (kg)</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynamic Stall Force (N)</td>
<td>32</td>
</tr>
<tr>
<td>Motor Stiffness (N/µ)</td>
<td>3.0</td>
</tr>
<tr>
<td>Outgassing data</td>
<td>&lt;1% TML; &lt;0.1% CVCM</td>
</tr>
</tbody>
</table>

MECHANICAL DRAWINGS

[All drawings are shown in European view]

4x Ø5.6 THRU ALL
Ø10 Ø5.8 MOUNTING HOLES C-BORED FARSIDE

Linear Piezo Vacuum Stage

FBV075040-10008

Nanomotion Ltd.
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
t: +972 73 2498000
t: +972 73 2498099
e: nano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 821-6266
t: (631) 585-3000
t: (631) 585-1947
e: nanous@nanomotion.com

A Johnson Electric Company
Product Features

- Travel Range up to 60mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**TECHNICAL SPECIFICATIONS**

**Mechanical Design Characteristics**

- **Stage Plate Structure**: Aluminum
- **Motor**: Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings**: Precision crossed roller with anti-migration device
- **Encoder**: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
- **Cable Lengths**: 3m
- **MTBF**: 30,000 hours
- **Stage Mass (g)**: 1,025
- **Moving Mass (g)**: 405

**Performance Specifications**

- **Travel Range (mm)**: 60
- **Encoder Resolution (µm)**: 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm)**: 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec)**: 250
- **Straightness & Flatness (µm)**: +/- 4
- **Pitch & Yaw (µrad)**: +/- 40
- **Load Capacity (horizontal) (kg)**: 3
- **Load Capacity (vertical lift) (kg)**: 1.0
- **Dynamic Stall Force (N)**: 32
- **Motor Stiffness (N/µ)**: 3.0

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]
FBV075060-10008  Linear Piezo Vacuum Stage

Product Features

- Travel Range up to 60mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
Linear Piezo Vacuum Stage

MECHANICAL DRAWINGS
[All drawings are shown in European view]
Linear Piezo Stage

Product Features

- Travel Range up to 100mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).

Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**TECHNICAL SPECIFICATIONS**

### Mechanical Design Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Motor</td>
<td>Piezo Electric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td>Linear Bearings</td>
<td>Precision crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder</td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
<tr>
<td>Cable Lengths</td>
<td>3m</td>
</tr>
<tr>
<td>MTBF</td>
<td>30,000 hours</td>
</tr>
<tr>
<td>Stage Mass (g)</td>
<td>1,230</td>
</tr>
<tr>
<td>Moving Mass (g)</td>
<td>515</td>
</tr>
</tbody>
</table>

### Performance Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Range (mm)</td>
<td>100</td>
</tr>
<tr>
<td>Encoder Resolution (µm)</td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td>Bi-directional Repeatability (µm)</td>
<td>1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td>Maximum Velocity (mm/sec)</td>
<td>250</td>
</tr>
<tr>
<td>Straightness &amp; Flatness (µm)</td>
<td>+/- 5</td>
</tr>
<tr>
<td>Pitch &amp; Yaw (µrad)</td>
<td>+/- 60</td>
</tr>
<tr>
<td>Load Capacity (horizontal) (kg)</td>
<td>3</td>
</tr>
<tr>
<td>Load Capacity (vertical lift) (kg)</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynamic Stall Force (N)</td>
<td>32</td>
</tr>
<tr>
<td>Motor Stiffness (N/µ)</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]
Product Features

- Travel Range up to 100mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
- Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

**Mechanical Design Characteristics**

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision stainless steel crossed roller with anti-migration device
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

- **Cable Lengths:** 3m
- **MTBF:** 30,000 hours
- **Stage Mass (g):** 1,230
- **Moving Mass (g):** 515

**Performance Specifications**

- **Travel Range (mm):** 100
- **Encoder Resolution (µm):** 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec):** 250
- **Straightness & Flatness (µm):** +/- 5
- **Pitch & Yaw (µrad):** +/- 60
- **Load Capacity (horizontal) (kg):** 3
- **Load Capacity (vertical lift) (kg):** 1.0
- **Dynamic Stall Force (N):** 32
- **Motor Stiffness (N/µ):** 3.0
- **Outgassing data:** <1% TML; <0.1% CVCM

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]
Product Features

- Travel Range up to 100mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
- Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

Stage Plate Structure: Aluminum
Motor: Piezo Electric, Ultrasonic Standing Wave
Linear Bearings: Precision crossed roller with anti-migration device
Encoder: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

Performance Specifications

Travel Range (mm): 100
Encoder Resolution (µm): 0.1 standard; (10nm optional)
Bi-directional Repeatability (µm): 1.0 standard; (0.1µm optional)
Maximum Velocity (mm/sec): 250
Straightness & Flatness (µm): +/- 4
Pitch & Yaw (µrad): +/- 50
Load Capacity (horizontal) (kg): 3
Load Capacity (vertical lift) (kg): 1.0
Dynamic Stall Force (N): 32
Motor Stiffness (N/µ): 3.0

MECHANICAL DRAWINGS

[All drawings are shown in European view]
FBV100100-10008
Linear Piezo Vacuum Stage

Product Features

- Travel Range up to 100mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**FBV100100-10008**

**Linear Piezo Vacuum Stage**

---

**TECHNICAL SPECIFICATIONS**

**Mechanical Design Characteristics**

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision stainless steel crossed roller with anti-migration device
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Lengths</td>
<td>3m</td>
</tr>
<tr>
<td>MTBF</td>
<td>30,000 hours</td>
</tr>
<tr>
<td>Stage Mass (g)</td>
<td>2,145</td>
</tr>
<tr>
<td>Moving Mass (g)</td>
<td>930</td>
</tr>
</tbody>
</table>

**Performance Specifications**

- **Travel Range (mm):** 100
- **Encoder Resolution (µm):** 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec):** 250
- **Straightness & Flatness (µm):** +/- 4
- **Pitch & Yaw (µrad):** +/- 50
- **Load Capacity (horizontal) (kg):** 3
- **Load Capacity (vertical lift) (kg):** 1.0
- **Dynamic Stall Force (N):** 32
- **Motor Stiffness (N/µ):** 3.0

**Outgassing data:** <1% TML; <0.1% CVCM

---

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]

---

Nanomotion Ltd.
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20992 Israel

- t: +972 73 2498000
- f: +972 73 2498099
- e: nano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779

- t: (800) 821-6266
- f: (631) 585-3000
- e: nanoUS@nanomotion.com

---

A Johnson Electric Company

www.nanomotion.com
FBS150150-10008  Linear Piezo Stage

Product Features

- Travel Range up to 150mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
### TECHNICAL SPECIFICATIONS

#### Mechanical Design Characteristics

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision crossed roller with anti-migration device
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

#### Performance Specifications

- **Travel Range (mm):** 150
- **Encoder Resolution (µm):** 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec):** 250
- **Straightness & Flatness (µm):** +/- 4
- **Pitch & Yaw (µrad):** +/- 50
- **Load Capacity (horizontal) (kg):** 3
- **Load Capacity (vertical lift) (kg):** 1.0
- **Dynamic Stall Force (N):** 32
- **Motor Stiffness (N/µ):** 3.0

### MECHANICAL DRAWINGS

[All drawings are shown in European view]

---

Nanomotion Ltd.
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
 t: +972 73 2498000
t: +972 73 2498089
e: nano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 821-6266
t: (631) 585-3000	n: (631) 585-1947
e: nanoUS@nanomotion.com

---

www.nanomotion.com
Product Features

- Travel Range up to 100mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**Linear Piezo Vacuum Stage**

**FBV150150-10008**

### TECHNICAL SPECIFICATIONS

#### Mechanical Design Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Motor</td>
<td>Piezo Electric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td>Linear Bearings</td>
<td>Precision stainless steel crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder</td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
<tr>
<td>Cable Lengths</td>
<td>3m</td>
</tr>
<tr>
<td>MTBF</td>
<td>30,000 hours</td>
</tr>
<tr>
<td>Stage Mass (g)</td>
<td>5,095</td>
</tr>
<tr>
<td>Moving Mass (g)</td>
<td>2,125</td>
</tr>
</tbody>
</table>

#### Performance Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Range (mm)</td>
<td>150</td>
</tr>
<tr>
<td>Encoder Resolution (µm)</td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td>Bi-directional Repeatability (µm)</td>
<td>1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td>Maximum Velocity (mm/sec)</td>
<td>250</td>
</tr>
<tr>
<td>Straightness &amp; Flatness (µm)</td>
<td>+/- 4</td>
</tr>
<tr>
<td>Pitch &amp; Yaw (µrad)</td>
<td>+/- 50</td>
</tr>
<tr>
<td>Load Capacity (horizontal) (kg)</td>
<td>3</td>
</tr>
<tr>
<td>Load Capacity (vertical lift) (kg)</td>
<td>1.0</td>
</tr>
<tr>
<td>Dynamic Stall Force (N)</td>
<td>32</td>
</tr>
<tr>
<td>Motor Stiffness (N/µ)</td>
<td>3.0</td>
</tr>
<tr>
<td>Outgassing data</td>
<td>&lt;1% TML; &lt;0.1% CVCM</td>
</tr>
</tbody>
</table>

### MECHANICAL DRAWINGS

[All drawings are shown in European view]
Product Features

- Travel Range up to 200mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

<table>
<thead>
<tr>
<th>Stage Plate Structure:</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor:</strong> Piezo Electric, Ultrasonic Standing Wave</td>
<td></td>
</tr>
<tr>
<td><strong>Linear Bearings:</strong> Precision crossed roller with anti-migration device</td>
<td></td>
</tr>
<tr>
<td><strong>Encoder:</strong> Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
<td></td>
</tr>
<tr>
<td><strong>Cable Lengths:</strong> 3m</td>
<td></td>
</tr>
<tr>
<td><strong>MTBF:</strong> 30,000 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Stage Mass (g):</strong> 6,275</td>
<td></td>
</tr>
<tr>
<td><strong>Moving Mass (g):</strong> 2,660</td>
<td></td>
</tr>
</tbody>
</table>

Performance Specifications

| **Travel Range (mm):** 200 |
| **Encoder Resolution (µm):** 0.1 standard; (10nm optional) |
| **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional) |
| **Maximum Velocity (mm/sec):** 250 |
| **Straightness & Flatness (µm):** +/- 5 |
| **Pitch & Yaw (µrad):** +/- 50 |
| **Load Capacity (horizontal) (kg):** 3 |
| **Load Capacity (vertical lift) (kg):** 1.0 |
| **Dynamic Stall Force (N):** 32 |
| **Motor Stiffness (N/µ):** 3.0 |

MECHANICAL DRAWINGS

[All drawings are shown in European view]

Nanomotion Ltd.
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20992 Israel
t: +972 73 2498000
t: +972 73 2498099
e: nano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 821-6266
t: (631) 585-3000
t: (631) 585-1947
e: nanoUS@nanomotion.com
FBV150200-10008 Linear Piezo Vacuum Stage

Product Features

- Travel Range up to 200mm
- Motor: HR8
- Velocity up to 250mm/sec
- Load capacity up to 3kg
- Encoder resolution 0.1µm (optional to 10nm).
  Mounted on axis center

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
Linear Piezo Vacuum Stage

**Technical Specifications**

<table>
<thead>
<tr>
<th>Mechanical Design Characteristics</th>
<th>Performance Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure: Aluminum</td>
<td><strong>Travel Range (mm):</strong> 200</td>
</tr>
<tr>
<td><strong>Motor:</strong> Piezo Electric, Ultrasonic Standing Wave</td>
<td><strong>Encoder Resolution (µm):</strong> 0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td><strong>Linear Bearings:</strong> Precision stainless steel crossed roller with anti-migration device</td>
<td><strong>Bi-directional Repeatability (µm):</strong> 1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td><strong>Encoder:</strong> Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
<td><strong>Maximum Velocity (mm/sec):</strong> 250</td>
</tr>
<tr>
<td><strong>Cable Lengths:</strong> 3m</td>
<td><strong>Straightness &amp; Flatness (µm):</strong> +/- 5</td>
</tr>
<tr>
<td><strong>MTBF:</strong> 30,000 hours</td>
<td><strong>Pitch &amp; Yaw (µrad):</strong> +/- 50</td>
</tr>
<tr>
<td><strong>Stage Mass (g):</strong> 6,275</td>
<td><strong>Load Capacity (horizontal) (kg):</strong> 3</td>
</tr>
<tr>
<td><strong>Moving Mass (g):</strong> 2,660</td>
<td><strong>Load Capacity (vertical lift) (kg):</strong> 1.0</td>
</tr>
</tbody>
</table>

**Performance Specifications**

- **Travel Range (mm):** 200
- **Encoder Resolution (µm):** 0.1 standard; (10nm optional)
- **Bi-directional Repeatability (µm):** 1.0 standard; (0.1µm optional)
- **Maximum Velocity (mm/sec):** 250
- **Straightness & Flatness (µm):** +/- 5
- **Pitch & Yaw (µrad):** +/- 50
- **Load Capacity (horizontal) (kg):** 3
- **Load Capacity (vertical lift) (kg):** 1.0
- **Dynamic Stall Force (N):** 32
- **Motor Stiffness (N/µ):** 3.0
- **Outgassing data:** <1% TML; <0.1% CVCM

**Mechanical Drawings**

[All drawings are shown in European view]

---

Nanomotion Ltd.
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
\t+\t+972 73 2496000
\t+\t+972 73 2496099
\t\t\t\t\tnano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
\t(800) 821-6266
\t(631) 585-3000
\t(631) 585-1947
\tnanoUS@nanomotion.com

A Johnson Electric Company
www.nanomotion.com

32
Vertical Piezo Stage

**Product Features**

- Travel Range up to 10mm
- Motor: HR4
- Velocity up to 50mm/sec
- Load capacity up to 2.5kg
- Encoder resolution 0.1μm (optional to 10nm). Mounted directly to vertical displacement surface

**Product Description**

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**Vertical Piezo Stage**

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]

**TECHNICAL SPECIFICATIONS**

**Mechanical Design Characteristics**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure:</td>
<td>Aluminum</td>
</tr>
<tr>
<td><strong>Motor</strong>: Piezo Electric, Ultrasonic Standing Wave</td>
<td></td>
</tr>
<tr>
<td>Linear Bearings:</td>
<td>Precision crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder:</td>
<td>Linear optical scale with 20μm signal period and 0.1μm resolution, with home reference mark</td>
</tr>
<tr>
<td><strong>Cable Lengths:</strong></td>
<td>3m</td>
</tr>
<tr>
<td><strong>MTBF:</strong></td>
<td>30,000 hours</td>
</tr>
<tr>
<td><strong>Stage Mass (g):</strong></td>
<td>1,100</td>
</tr>
</tbody>
</table>

**Performance Specifications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel Range (mm):</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>Encoder Resolution (μm):</strong></td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td><strong>Bi-directional Repeatability (μm):</strong></td>
<td>1.0 standard; (0.1μm optional)</td>
</tr>
<tr>
<td><strong>Maximum Velocity (mm/sec):</strong></td>
<td>50</td>
</tr>
<tr>
<td><strong>Straightness &amp; Flatness (μm):</strong></td>
<td>+/- 2</td>
</tr>
<tr>
<td><strong>Pitch &amp; Yaw (μrad):</strong></td>
<td>+/- 30</td>
</tr>
<tr>
<td><strong>Load Capacity (kg):</strong></td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Dynamic Stall Force (N):</strong></td>
<td>80</td>
</tr>
<tr>
<td><strong>Motor Stiffness (N/μ):</strong></td>
<td>2.8</td>
</tr>
</tbody>
</table>

---

**Nanomotion Ltd.**
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692, Israel

**Nanomotion Inc.**
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779

Phone: +972 73 2498000
Fax: +972 73 2498099
Email: nano@nanomotion.com

Phone: (800) 821-6266
Fax: (631) 585-3000
Email: nanous@nanomotion.com

www.nanomotion.com
**Product Features**

- Travel Range up to 10mm
- Motor: HR4
- Velocity up to 50mm/sec
- Load capacity up to 2.5kg
- Encoder resolution 0.1µm (optional to 10nm). Mounted directly to vertical displacement surface

**Product Description**

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FZV075010-10004</td>
<td>Vacuum Stage up to 10^{-7} Torr</td>
</tr>
<tr>
<td>FZUV075010-10004</td>
<td>UHV Stage up to 10^{-10} Torr</td>
</tr>
</tbody>
</table>
.Vertical Piezo Vacuum Stage

**TECHNICAL SPECIFICATIONS**

**Mechanical Design Characteristics**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage Plate Structure</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Motor</td>
<td>Piezoelectric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td>Linear Bearings</td>
<td>Precision crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder</td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
<tr>
<td>Cable Lengths</td>
<td>3m</td>
</tr>
<tr>
<td>MTBF</td>
<td>30,000 hours</td>
</tr>
<tr>
<td>Stage Mass (g)</td>
<td>1,100</td>
</tr>
</tbody>
</table>

**Performance Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Range (mm)</td>
<td>10</td>
</tr>
<tr>
<td>Encoder Resolution (µm)</td>
<td>0.1 standard; (10nm optional)</td>
</tr>
<tr>
<td>Bi-directional Repeatability (µm)</td>
<td>1.0 standard; (0.1µm optional)</td>
</tr>
<tr>
<td>Maximum Velocity (mm/sec)</td>
<td>100</td>
</tr>
<tr>
<td>Straightness &amp; Flatness (µm)</td>
<td>+/- 2</td>
</tr>
<tr>
<td>Pitch &amp; Yaw (µrad)</td>
<td>+/- 30</td>
</tr>
<tr>
<td>Load Capacity (kg)</td>
<td>2.5</td>
</tr>
<tr>
<td>Dynamic Stall Force (N)</td>
<td>80</td>
</tr>
<tr>
<td>Motor Stiffness (N/µ)</td>
<td>2.8</td>
</tr>
<tr>
<td>Outgassing Data</td>
<td>&lt;1% TML; &lt;0.1% CVCM</td>
</tr>
</tbody>
</table>

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]
Tilt Stage

Product Features

- Travel Range up to +/- 10°
- Motor: HR4
- Velocity up to 40°/sec
- Load capacity up to 1kg
- Encoder resolution 0.176 arc seconds
- Pivot Axis 101.4mm

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
MECHANICAL SPECIFICATIONS

Mechanical Design Characteristics

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision ball-V guide bearings
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark

- **Cable Lengths:** 3m
- **MTBF:** 30,000 hours
- **Stage Mass (g):** 940
- **Moving Mass (g):** 500

Performance Specifications

- **Travel Range (deg):** 10
- **Encoder Resolution (µm):** 0.176 arc seconds; 0.0176 arc seconds optional
- **Bi-directional Repeatability (µm):** 2 arc seconds; 0.2 arc seconds optional
- **Maximum Velocity (deg/sec):** 40
- **Straightness & Radial Runout (µm):** +/- 2
- **Pitch & Yaw (µrad):** +/- 30
- **Load Capacity (kg):** 1
- **Dynamic Stall Force (N):** 16
- **Motor Stiffness (N/µ):** 2.8

MECHANICAL DRAWINGS

[All drawings are shown in European view]
The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.

### Product Features
- Travel Range up to +/-10°
- Motor: HR4
- Velocity up to 40°/sec
- Load capacity up to 1kg
- Encoder resolution 0.176 arc seconds
- Pivot Axis 101.4mm

### Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
**TECHNICAL SPECIFICATIONS**

**Mechanical Design Characteristics**

- **Stage Plate Structure**: Aluminum
- **Motor**: Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings**: Precision crossed roller with anti-migration device
- **Encoder**: Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
- **Cable Lengths**: 3m
- **MTBF**: 30,000 hours
- **Stage Mass (g)**: 940
  - Moving Mass (g): 500

**Performance Specifications**

- **Travel Range (deg)**: 10
- **Encoder Resolution (µm)**: 0.176 arc seconds; 0.0176 arc seconds optional
- **Bi-directional Repeatability (µm)**: 2 arc seconds; 0.2 arc seconds optional
- **Maximum Velocity (deg/sec)**: 40
- **Straightness & Radial Runout (µm)**: +/- 2
- **Pitch & Yaw (µrad)**: +/- 30
- **Load Capacity (kg)**: 1
- **Dynamic Stall Force (N)**: 16
- **Motor Stiffness (N/µ)**: 2.8
- **Outgassing Data**: <1% TML; <0.1% CVCM

**MECHANICAL DRAWINGS**

[All drawings are shown in European view]
FGS100160-10004 Tilt Stage

Product Features

- Travel Range up to +/-10°
- Motor: HR4
- Velocity up to 40°/sec
- Load capacity up to 1kg
- Encoder resolution 0.135 arc seconds
- Pivot axis 136.4mm

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
## TECHNICAL SPECIFICATIONS

**Mechanical Design Characteristics**

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision crossed roller with anti-migration device
- **Encoder:** Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark
- **Cable Lengths:** 3m
- **MTBF:** 30,000 hours
- **Stage Mass (g):** 940
- **Moving Mass (g):** 500

**Performance Specifications**

- **Travel Range (deg):** 10
- **Encoder Resolution (µm):** 0.135 arc seconds; 0.0135 arc seconds optional
- **Bi-directional Repeatability (µm):** 2 arc seconds; 0.2 arc seconds optional
- **Maximum Velocity (deg/sec):** 40
- **Straightness & Radial Runout (µm):** +/- 2
- **Pitch & Yaw (µrad):** +/- 30
- **Load Capacity (kg):** 1
- **Dynamic Stall Force (N):** 16
- **Motor Stiffness (N/µ):** 2.8

## MECHANICAL DRAWINGS

[All drawings are shown in European view]
The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

<table>
<thead>
<tr>
<th>Stage Plate Structure:</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor:</td>
<td>Piezo Electric, Ultrasonic Standing Wave</td>
</tr>
<tr>
<td>Linear Bearings:</td>
<td>Precision crossed roller with anti-migration device</td>
</tr>
<tr>
<td>Encoder:</td>
<td>Linear optical scale with 20µm signal period and 0.1µm resolution, with home reference mark</td>
</tr>
</tbody>
</table>

Cable Lengths: 3m

MTBF: 30,000 hours

Stage Mass (g): 940

Moving Mass (g): 500

Performance Specifications

<table>
<thead>
<tr>
<th>Travel Range (deg):</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder Resolution (µm):</td>
<td>0.135 arc seconds; 0.0135 arc seconds optional</td>
</tr>
<tr>
<td>Bi-directional Repeatability (µm):</td>
<td>2 arc seconds; 0.2 arc seconds optional</td>
</tr>
<tr>
<td>Maximum Velocity (deg/sec):</td>
<td>40</td>
</tr>
<tr>
<td>Straightness &amp; Radial Runout (µm):</td>
<td>+/- 2</td>
</tr>
<tr>
<td>Pitch &amp; Yaw (µrad):</td>
<td>+/- 30</td>
</tr>
<tr>
<td>Load Capacity (kg):</td>
<td>1</td>
</tr>
<tr>
<td>Dynamic Stall Force (N):</td>
<td>16</td>
</tr>
<tr>
<td>Motor Stiffness (N/µ):</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Outgassing Data: <1% TML; <0.1% CVCM

MECHANICAL DRAWINGS

[All drawings are shown in European view]
Rotary Piezo Stage

Product Features

- Travel Range 360° - continuous
- Motor: (1) HR2 or (2)HR2
- Velocity up to 180°/sec
- Load capacity up to 2kg (at Ring)
- Encoder resolution
  0.2 arc seconds

Product Description

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

- **Stage Plate Structure:** Aluminum
- **Motor:** Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings:** Precision rotary crossed roller
- **Encoder:** Optical scale with metal ring
- **Cable Lengths:** 3m
- **Stage Mass (g):** 820

Performance Specifications

- **Travel Range (degrees):** 360 - continuous
- **Encoder Resolution (arc seconds):** 5 arc seconds
  
  (0.5 arc seconds optional)
- **Bi-directional Repeatability (arc seconds):** 50 arc seconds
  
  (5 arc seconds optional)
- **Maximum Velocity (deg/sec):** 180
- **Flatness (µm):** 5
- **Radial Runout (µm):** 5
- **Load Capacity (horizontal) (kg):** 2
- **Dynamic Stall Torque (N):** 0.44 (at Ring)
- **Motor Stiffness (N/µ):** 2.8

MECHANICAL DRAWINGS

[All drawings are shown in European view]
Rotary Piezo Vacuum Stage

**Product Features**

- Travel Range 360° - continuous
- Motor: (1) HR2 or (2) HR2
- Velocity up to 90°/sec
- Load capacity up to 2kg (at Ring)
- Encoder resolution 0.2 arc seconds

**Product Description**

The FB Series of alignment stages are driven by Nanomotion’s ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRV060360-00504</td>
<td>Vacuum Stage up to 10⁻⁷ Torr</td>
</tr>
<tr>
<td>FRU060360-00504</td>
<td>UHV Stage up to 10⁻¹⁰ Torr</td>
</tr>
</tbody>
</table>

www.nanomotion.com
TECHNICAL SPECIFICATIONS

Mechanical Design Characteristics

- **Stage Plate Structure**: Aluminum
- **Motor**: Piezo Electric, Ultrasonic Standing Wave
- **Linear Bearings**: Precision rotary stainless steel crossed roller
- **Encoder**: Optical scale with metal ring
- **Cable Lengths**: 3m
- **Stage Mass (g)**: 820

Performance Specifications

- **Travel Range (degrees)**: 360 - continuous
- **Encoder Resolution (arc seconds)**: 5 arc seconds (0.5 arc seconds optional)
- **Bi-directional Repeatability (arc seconds)**: 50 arc seconds (5 arc seconds optional)
- **Maximum Velocity (deg/sec)**: 180
- **Flatness (µm)**: 5
- **Radial Runout (µm)**: 5
- **Load Capacity (horizontal) (kg)**: 2
- **Dynamic Stall Torque (N)**: 0.44 (at Ring)
- **Motor Stiffness (N/µ)**: 2.8
- **Outgassing Data**: <1% TML; <0.1% CVCM

MECHANICAL DRAWINGS

[All drawings are shown in European view]
FB Series

Technical Section

Product Features

- Linear stages for 20mm to 200mm travel.
- Rotary Stage for continues motion
- Z-Wedge stage for 10mm travel
- Nanomotion's direct drive piezo motor with zero backlash and no hysteresis.
- Integrated 100nm (0.1µm) optical encoder.

Product Description

The FB Series of alignment stages are driven by Nanomotion's ultrasonic standing wave piezo motors, providing linear, rotary and vertical motion.

The FB Series of stages provide single and multi-axis motion performance for a wide range of applications in optical alignment, semiconductor, biomedical, and the analytical instrumentation markets. These compact stages are provided in both atmosphere and vacuum configurations and can support clean room operation to Class 10.

The FB Series is a modular design that allows for easy mounting for multi-axis applications. All FB Series stages are designed with precision optical encoders and precision crossed roller bearings, with the linear axes having an anti-migration device.
A linear axis has six degrees of freedom that can create potential errors in motion. There are 3 degrees of linear errors, considering the linear displacement (travel), Straightness of motion, & Flatness of motion. There are 3 degrees of angular error, which consist of Pitch, Yaw, and Roll.

1. The movement in the direction of translation, which is the actual motion displacement. This accuracy is governed by the precision of the feedback device and the ability of the motor/servo system to control the displacement of motion.

2. Straightness & Flatness are linear errors related to deviations in motion in a vertical plane or left/right plane.

3. Pitch & Yaw are angular errors that result in inclination (pitch) or twisting (yaw) of the moving surface, about the direction of travel.

4. Roll is an angular error that results in the tilting of the moving surface, off to the side, of the direction of motion.

Nanomotion’s FB Linear Series uses precision crossed roller bearings, yielding high stiffness, low friction and minimizing the linear and angular errors. The mounting surfaces for the bearings are precision machined aluminum, designed to reflect the bearing accuracy.
Vacuum & Ultra High Vacuum Compatibility & Cleanliness

Nanomotion’s infrastructure includes:
- Cleaning and baking equipment
- Residual Gas Analysis Equipment
- Cleanroom for assembly and testing
- Vacuum chambers for testing
- Particle counting

Nanomotion supports all vacuum/UHV applications with well established infrastructure for RGA analysis and performance testing in vacuum. Our cleanroom supports the assembly and testing of ultra-clean stages.

Nanomotion Motors & Stages are available in:
- V version for high vacuum (10^-7 Torr)
- U version for Ultra High Vacuum (10^-10 Torr)

Linear, rotary, tilt, and Z-wedge stages are configure specifically for vacuum / UHV environments, assembled and tested in a cleanroom, then packaged in dry air or nitrogen. Single and multi-axis assemblies are available to meet the most demanding motion requirements.

Nanomotion’s motors and stages are available in vacuum and UHV compatible configurations, leveraging extensive research on materials, adhesives, and lubricants, providing high performance motion control. Motion systems are specifically designed and manufactured to meet the most stringent performance along with vacuum compatibility and cleanliness.
Move and Settle Motion Profiles & Braking

The ability to step and settle to a stable position is essential to many motion applications. Nanomotion’s piezo stages have:

- zero backlash
- zero hysteresis
- no internal motor inertia
- faster response than traditional motor technology

The ability to accelerate an axis with Nanomotion’s piezo motor technology is greatly enhanced as the inertia only comes from the moving load. Aside from an ultrasonic standing wave, there are no moving parts internal to the motor. The ability to stop (brake) and hold position with stability is also enhanced by the inherent friction of the ceramic tip working on a ceramic drive surface. These characteristics allow for optimum move and settle, along with the ultimate in position stability.

The ability to make more than 20 moves in 1 second, averaging 50msec, for move and settle, is demonstrated over 25 million cycles.

The motion profile below reflects the position and velocity profile, reaching position stability at the end of the move command, settling to +/- 1 encoder count. The drift (position stability) is measured at <5nm per minute.
Position Repeatability and Accuracy
In The Direction of Motion

The graph above represents a test, simulating 5 years of operation service, moving 90°, 180°, 270°, 360° and back to home.

Accuracy in our normal servo mode (AC) is to 1µRad
Accuracy in our high resolution mode (DC) is to 0.1µRad
Position repeatability is to +/- 1 µRad
There are many design and component factors that impact the ability to achieve position repeatability and accuracy.

All Nanomotion motion systems are closed loop with a position sensor. The position sensors vary in the available resolution and the absolute accuracy. In addition to the position sensors, design considerations that impact the systems stiffness, materials (thermal expansion) and bearing selection are all key factors in determining the precision of motion.

Nanomotion has extensive experience in system configurations ranging from 0.5nm resolution to 1µm resolution. Ultimately the position resolution will be a key factor in determining the position repeatability, as most systems will be repeatable to < 5 encoder counts. Actual errors in the position sensor can be factored out based on measurements with a laser interferometer or auto collimator, yielding standard accuracy in the sub-micron level and achievable accuracy in nanometer level.

Nanomotion utilizes metrology tools such as laser interferometry and auto collimators to validate all aspects of motion performance.

The long travel stage to the right and the graph below reflect an absolute position accuracy of 12 microns over 306mm. The position repeatability is 2 microns with a 0.1µm resolution encoder.

Increasing the encoder resolution can improve position repeatability.

Laser error mapping can improve position accuracy by adding correction points.
Application Data Sheet

Please use this as a guideline to the stage selection process

Name: ______________________________________________________________________________________________

Company: ____________________________________________________________________________________________

Phone: ____________________________________________ Email: ____________________________________________

Application Description

Describe the application in text
____________________________________________________________________________________________________
____________________________________________________________________________________________________
____________________________________________________________________________________________________

Operating Environment

Min/Max Operating Temperature ___________________________ – ___________________________ [C/F]

Min/Max Storage Temperature ___________________________ – ___________________________ [C/F]

Pressure/Vacuum ______________________________________ [Torr]

Magnetic: ☐ Yes ☐ No

Cleanliness Class: ____________________________________________

Other Environmental Considerations:
____________________________________________________________________________________________________
____________________________________________________________________________________________________
____________________________________________________________________________________________________

Multi Axis Configurations

Choose configuration and define which axis is top of each other.

X ______________________________________________

R ______________________________________________

XR _____________________________________________

XY _____________________________________________

XZ _____________________________________________

Example: Z mounted onto X with

ZR _____________________________________________

XYZ ___________________________________________

XYR ___________________________________________

XYZ ___________________________________________

XYZR ___________________________________________

R1R2 ___________________________________________

Other ___________________________________________

Number of Interpolated axes ____________________________

www.nanomotion.com
Application Data Sheet

Please use this as a guideline to the stage selection process

**Positioning Requirements**

Repeatable  
The error returning to the same position ________________________________ [nm/µ]

Absolute Accuracy  
The error from position zero to a target point: ________________________________ [µm]

Typical Step Size  
__________________________________________________________________________ [nm/µm/mm]

Smallest Incremental Step  
__________________________________________________________________________ [nm/µm]

Encoder Resolution  
Nanomotion to define encoder resolution. ________________________________ [nm/µm]

**Motion Requirements**  
Maximum Travel per axis:

X ______________________ Y ______________________ Z ________________________ [mm]

R1 ____________________ R2 ______________________ [Degrees or Continuous]

Define:  
Constant Velocity (speed uniformity at what velocity and over what distance)
__________________________________________________________________________

Move and Settle (move distance and time)
__________________________________________________________________________

**Load Requirements**

Payload Mass  
__________________________________________________________________________ [Kg]

Thrust Force  
__________________________________________________________________________ [N]

Payload directly mounted to the stage surface  
☐ Yes  ☐ No

Distance from the stage surface to the CoG of the payload  
__________________________________________________________________________ [mm]

Please sketch on Axes Configuration chart for multi-axes configuration

Rotary Application, define moment of inertia  
__________________________________________________________________________ [kg.m²]

**Electrical**

Main Power:  
☐ 12V  ☐ 24V  ☐ 48V  ☐ Battery ______________________  ☐ Other ______________________________

**Controller**

Nanomotion:  
__________________________________________________________________________

Other Brand:  
__________________________________________________________________________

**Controller Interface**  
Define specific requirements in communication protocol, packaging or interfacing with other devices:
__________________________________________________________________________

**Motor Amplifier**  
Nanomotion to determine driver:  
__________________________________________________________________________